Building international environmental alliances

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The history of the Massachusetts Institute of Technology is linked very closely with both the development of technologies for national security and with industrial development in the United States. Through our partnerships with government and industry we have found the coexistence of fundamental scientific research with advanced technological research to be very effective in working toward innovative solutions to a wide range of national defense, economic, and social issues. Today, *global* environmental issues are very much in the forefront of our educational and research agenda. Because the issues are global, we recognize the need to work with other universities with complimentary strengths—and similar relationships with industry and government—to fulfill our educational and research mission in this new realm. Hence, the creation of the Alliance for Global Sustainability. This partnership of three technical research universities worldwide—MIT, the Swiss Federal Institutes of Technology, and the University of Tokyo—was established to develop new and innovative policies, industrial processes, and technologies that are needed to ensure a sustainable and secure global future.

Sustainability, national security, and the need for cooperation

Although terms like "sustainable development" and "sustainability" have gained currency ever since publication of the now famous Bruntland Commission report "Our Common Future" in the early 1980s, many people are uneasy using them. What, they ask, do these vague and indefinite terms mean to human development and progress? What are the benchmarks? How do we know we are meeting them—whether we are in business, industry, government—or, for that matter, as individuals in our choices of daily living? I am not foolish enough to attempt a definition here. It would be impossible for our purposes to try to condense the voluminous work that has been carried out to define and operationalize these terms. However, it is clear that they embrace two concepts that are also fundamental to the provision of security: futurity and equity. Sustainability is primarily an issue of intergenerational equity. As the framers of the Bruntland Commission put it, sustainability means that consumption and development of the present generation should not come at the expense of development of future generations (World Commission on Environment and Development 1987). This is not to say that sustainability issues are relevant only to the distant and unforeseeable future. Were this the case, one might be tempted to take the technological optimist's view that market demands will eventually result in the development of the technologies needed to correct negative effects of older ways of doing business. In fact, the situation is more urgent than that. The notions of futurity and equity also apply to immediate concerns about disproportionate development within highly industrialized countries and, clearly, between developed and developing economies.

To my mind, widespread use of the terms "sustainable development" and

"sustainability"—and many international attempts to define them—reflects growing global concerns about modern patterns of industrial and economic development, and unease about ensuing environmental decline and persistent economic inequities. In a world of limited capital resources, burgeoning populations, and increasingly intense energy consumption, demands for rapid development pose formidable immediate challenges to all institutions in developed and developing countries alike. In a world of burgeoning populations where basic human needs cannot be met, the notion of security is closely linked to the concepts of futurity (development) and equity.

The world's population today is nearly six billion people. It is expected to reach eight billion before the middle of the next century, and perhaps double by the end of the next century. Yes, governments could act to stabilize population at lower levels, but as others have pointed out (MacNeill et.al. 1991), with one-third of the world's people under 15 years of age, even the most vigorous policies will not avert rapid population growth and the accompanying need for large increases in the provision of energy, transportation systems, and improved communication technologies. How to meet those demands without compromising resource availability, human health, and ecological balance is the challenge of sustainability. Failure to do so will clearly threaten security at many levels: local, national, regional, and global.

Let us briefly consider some of the evidence:

Rising numbers of people will increase global demand for food, fresh water, and shelter. But today, a combination of pollution, over-harvesting, and inefficient uses of technologies are threatening the sustainable yield in ocean fisheries, the amount of fresh water produced by the hydrological cycle, and the amount of arable land for sustainable agriculture. By the year 2000—no longer the distant future— nearly two billion people will not have access to safe drinking water. And although global food production has increased in the last 50 years, massive soil degradation and loss of top soil around the world is cause for increasing concern about the world's ability to meet basic nutritional needs. The global impacts of the regional problems are not difficult to anticipate. Environmental calamities in China, India, Africa, and Eastern Europe will resonate economically and socially throughout the world.

Beyond the regional scale environmental threats are those that compromise the global commons. For the first time in history, the integrity of the atmosphere is threatened by human activity. For many years, scientists have been issuing warnings about the impacts of industrial activity on the atmosphere—and the potential ensuing effects on the global environment and human health. Today, international negotiations at virtually the global scale are under way to address threats to the global commons.

The causes of global environmental problems—pollutants emitted as a result of worldwide modes of energy use, transportation, industry, farming, and forestry—are embedded in industrial and agricultural practices. These practices lie at the core of the highly competitive economies and lifestyles of the industrialized world and, increasingly, the developing world (Sebenius 1989). Competitive use of global resources to support these economies is the dilemma of the commons on a planetary scale. Environmental threats to the global commons share several characteristics that pose unique challenges to the political process. The shared characteristics that render these problems particularly thorny in the political context (and, hence relevant to security issues) and difficult to deal with are:

- The issues involve difficult tradeoffs between current economic or social benefits and uncertain adverse effects
- The issues are characterized by economic and scientific uncertainty
- The implications of this uncertainty are most pronounced with respect to potential effects
- The effects, if manifest, may be global
- The effects of long-term environmental threats are cumulative. They depend not just on what is happening now, but on the history of industrial and consumer activities

Briefly stated, global environmental challenges are complex, they lie at the intersection of economic and environmental goals, they transcend national borders, and no single country can address them alone. Moreover no institution whether industrial, public, or academic can provide complete solutions. Yet the strength of each can be enhanced by working together. In this context, the modern research university must play a major role.

The role of the research university

The role of the modern research university is rooted in three characteristics: a commitment to intellectual objectivity; an emphasis on the discovery and development of new scientific knowledge and new technologies; and a dedication to educating the next generation of scientists, engineers, and decision makers in society, industry, and government. It is through these characteristics that the university can make a contribution to overcoming environmental threats to security. Dealing with the difficult tradeoffs that will be needed to address global environmental threats will require the provision of neutral forums where stakeholders in the issue can meet and attempt to come to greater understanding. As objective analysts of global environmental problems and their consequences, universities are uniquely placed to fulfill the role of providing such forums.

We also play a major role in educating future decision makers to tackle these emerging and highly complex issues. Our central mission and primary responsibility is teaching. As MIT President Charles Vest emphasizes, "We must educate our students to understand both the importance and the complexity of environmental issues. Beyond that, we must provide them with the technical understanding, political awareness, and managerial acumen needed to deal with these issues in substantive ways. Sustainability is not a job for environmental experts or corporate health and safety officers alone. It is a consciousness that all leaders, designers, planners, and workers must bring to their work." (Vest 1996)

The foundation of intellectual objectivity is high quality scientific experimentation and thorough analysis. Understanding of global environmental threats and their potential consequences to security writ large will require two kinds of research—what Harvey Brooks (1982) has called "defensive" and "offensive." Defensive research is aimed at anticipating possible adverse effects of technology before they become manifest. Offensive research is designed to develop the basis of new products or services to meet new human needs or old needs better. The former depends on long-term fundamental research that has as its primary goal the generation of knowledge. In the context of global environmental issues, expertise for knowledge building within and across

many different fields will be necessary from the natural sciences, engineering, and social sciences. This is where our greatest contribution to global sustainability may be made. Our research challenge is to foster interaction among the diverse disciplinary fields needed to develop the scientific and technological base, to facilitate the policy discourse needed to understand the issues, and ultimately to solve the problems before us. Defensive research, on the other hand, requires the intimate knowledge of markets and competition that resides in industry. From this it is clear that the contributions that research universities can make to global sustainability—no matter how important—cannot be achieved in isolation. We cannot define by ourselves the research agenda nor build the educational and research resources needed to address these complex problems. In order to be effective we need to cooperate with industry, government, and other academic institutions—and we need to do this on a global basis.

In sum, the role of the university in sustainability can be summarized in four points:

- Educating professionals
- Enhancing multidisciplinary approaches to problem solving and ensuring environmental literacy across disciplines
- Working with industry and other stakeholder partners to set the research agenda, and to ensure the highest quality scientific experimentation and thorough analysis
- Applying the commitment to intellectual objectivity

Activism in this context means taking the university a step beyond its normal role, to working with industry and other stakeholder partners to set the research agenda to search for new solutions to complex environmental threats; to ensure that the knowledge we generate is accessible to decision and policymakers in all sectors; to provide an objective platform for discussion of complex issues; and, when possible, to facilitate negotiations on the difficult tradeoffs that are inherent in dealing with complex sustainability issues that lie at the intersection of economic and environmental goals.

MIT's international environmental alliances

At MIT we have many programs that are built on partnerships with government, industry, and other academic institutions. In the environmental area they include such activities as the Center for Global Change Science, the Joint Program on Global Change, the Program on Environmental Engineering Education and Research, the Sea Grant Program, the Parsons Hydrology Laboratory, the Center for Environmental Health Sciences. What is becoming increasingly evident, however, is the need to go a step further.

While the history of MIT is linked with industrial development in the United States and throughout the world, we must increasingly look toward active involvement in global technologic development and increasingly work with international partners in academia, government, and industry. We are pursuing a number of avenues to share our experiences in cooperating with industry to address complex technological and social problems—such as those that environmental threats represent—worldwide. At the same time, in building these alliances, we learn from the knowledge base of their academic and industry communities about the regional and even global impacts on,

and effects of, local environmental conditions, and industrial and social activity. For example, we are working with government, industry, and academic partners in several countries, such as Thailand, Malaysia, and Brazil to develop human resource capability within their academic and research institutions and to increase institutional capacity for transferring knowledge from these institutions to their industrial communities. These programs have a strong environmental component, which is essential to building modern technological capability within these countries themselves—and in particular to strengthening the local human resource base to deal with complex sustainability issues in development. In China, with our partners from Switzerland and Japan, we are working side-by-side with experts from Chinese universities, local communities, and government on the complex issues of the use of coal in China—especially in the small industrial and household sectors where the results of our research, combined with an education and training program, are likely to have a significant near-term effect.

The creation of these alliances in recent years suggests a new outward looking role of research universities. The trend reflects awareness that universities, like industry, simply cannot remain viable without an international focus. We are learning rapidly what it means to be part of a global system—that we really are all in this together. As one of my colleagues put it, "You can't sink half a boat—one end just doesn't go down without the other."

The Alliance for Global Sustainability

Knowledge of this led MIT to be part of the creation of the Alliance for Global Sustainability—partnership that allows the partner research universities to work together with representatives from industry and government worldwide to address issues of sustainability. The AGS captures MIT's interdisciplinary activity and focuses it on global environmental issues in partnership with universities in Europe, Asia, and Latin America, and with corporations and government representatives throughout the world. All of MIT's environmental, education, and research programs participate in it.

The AGS was created in 1994 specifically as an international forum to capture the results of research at our universities, supported by sponsoring companies, and to put these results to use in policy and regulatory formulation, in corporate planning, and in design and engineering. We see it as taking a step beyond the traditional role of universities to a more activist role.

Interdisciplinary and multigeographic research consortia are being built under the aegis of the AGS to develop new processes and technologies that are urgently needed to meet growing worldwide demand for energy, mobility, communication, habitat, and other essential building blocks of modern societies. Our targets are pathways to sustainability that we believe will emerge only from complex systems approaches to solving sustainability problems. But our goal is not only to generate knowledge, but to ensure that this knowledge is accessible for decision making at all levels—personal, private, and public. Thus, an important aim is to link groups that have the most power to mount an effective agenda. These are practitioners from industries that are already dealing with remediation, minimization, and prevention of environmental threats; government decision makers; representatives of environmental and social welfare activist groups who are in a position to influence policies throughout the world;

and researchers in academia who can convene contrasting points of view and apply rigorous peer review and independent verification of various proposed processes, policies, and technological solutions.

Drawing on the strengths of the partner institutions, the AGS is developing an ambitious agenda that is focusing on nine critical "pathways" to global sustainability. We now have research consortia developing agendas on global climate change which build synergistic strength from individual modeling efforts at each of the universities; on energy choices for the 21st century with a focus on "existing in a greenhouse constrained world"; on transportation and social mobility; the cumulative social and economic problems of the world's burgeoning megacities; the assurance of the availability of water and food in arid and semiarid regions of the world; the development of new greener technologies to meet development demands without compromising the future availability of natural resources, human health, and ecology; and on the development of policies that will enhance and facilitate sustainable practices in industry, through trade, and in personal choice. The AGS is also building a consortia on China in which all of these areas have particular significance not only for the integrity of China's environment and development, but with potential impacts throughout the world.

As the original title of this paper proposed by my colleague and leader of MIT's environmental initiatives, Professor David Marks, indicated when he called it "herding cats," the creation of the Alliance has not been easy. We face enormous challenges in working across great distances, different cultures, and with different partners in industry and government. But we are moving forward. The third annual meeting of the AGS at MIT in January 1997 includes the first meeting of our International Advisory Board and decisions on distribution of the first round of funding specifically for building the international AGS research consortia on the pathways to sustainability indicated above. We are encouraged by the external interest and support that the AGS has begun to garner—and we are already beginning to see the results of the international collaboration that the establishment of the AGS engendered. For example, our green design team is completing a text on comparative green design that will include chapters on international comparisons and policy perspectives: i.e. what policies may foster or hinder steps toward green design and innovation.

The AGS is a work in progress and, I believe, a harbinger of things to come: an academy that is more outward looking, more cooperative, and because of that, better equipped to educate students to meet the real challenges in industry and government of a rapidly changing, interdependent world.

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